4.4 Emerging Issues

Emerging issues are factors or trends, such as commodity demand, workforce and technology changes, that should be considered in planning the future of the NIOSH mining research program. Some of these trends and changes may provide opportunities to develop new and better solutions to existing health and safety problems. Other issues with potentially adverse safety or health consequences need to be identified early enough to allow intervention before workers are affected. The process time between the identification of a problem and the successful development and adoption of an effective solution can be measured in years. Thus our planning processes aim to identify "emerging issues" over the next five-to-ten year horizon. The emerging mining safety and health issues that we have identified are summarized here.

Production Demands

A significant change in the demand for commodities mined in the coal, nonmetal, and metal sectors would likely affect the injury and illness data that characterize the present workforce; and these changes could alter the priorities or direction of the mining research program. The Nation's increased need for energy would suggest a need for increased coal production, as would plans to develop a hydrogen economy, which would probably rely heavily on coal. However, concerns over emissions from fossil fuel use could temper any robust forecast for dramatically increased coal production. Credible forecasts suggest that coal production will grow modestly for years beyond the NIOSH research planning cycle. Hence, for our planning purposes we are assuming that coal mining will continue to be as important five years from now as it is today. Similarly, there is no evidence to suggest that nonmetal mining will change significantly in importance, and given the increasing activity in stone, sand, and gravel mining, this sector may increase in importance. Of the three sectors, metal mining has seen the greatest decline in production and numbers of workers, as operations have moved outside of the U.S. The changes that have occurred suggest that there is no need to increase the current level of health and safety research focused solely on metal mining. However, with material prices near real record levels and a likelihood that these prices may be sustained, it is likely that the level of underground mining in all sectors will increase. The challenges that will accompany any increased mining production from the US in all mining sectors are likely to come from more challenging environments.

Workforce Issues

Significant demographic changes are occurring in the mining workforce because of the impending eligibility for retirement of the Baby-Boomer cohort, limited hiring in many mining sectors over the past fifteen to twenty years, and the current high demand for specific commodities. Some mine sites now have exclusively older workers. While this more experienced worker is less likely to be injured on the job, when he or she is injured the results are often more severe than for a younger person. This severity results in longer recovery time and more lost work days than for younger workers. While the impacts of physically demanding tasks, such as heavy lifting or whole body vibration exposure, may not be apparent to the 30 or 40 year old miner, the musculoskeletal disorders resulting from performing these tasks over a career will be clearly seen in the older population. On the other hand, the demographic changes are and will be bringing many new inexperienced miners into the industry. The difficulty and complexity of the mining workplace necessitates a period of learning and adjustment for the

new hires when they will be at risk and when, through their inexperience, they may put others at risk. Moreover, the same demographic trends can found in the ranks of mine managers, mine engineers, mine inspectors, mining professors, and even mining researchers. The knowledge, skills, and judgment that will be lost with the retirement of the current older workforce have a huge potential for adverse impact on health and safety. Specifically, the following needs are forecast.

Help workers age successfully

We believe that the mining industry will benefit from the retention of older, experienced miners, and that certain changes will be required to minimize their risk of cumulative trauma disorders and traumatic injuries. Research is needed to develop tools and best practices for designing work tasks and processes to accommodate the physical capabilities and limitations of older workers. Workplaces should also be redesigned with considerations to naturally occurring aging changes, such as age-related changes in vision. In many cases, workplaces can be designed to be safer and healthier for employees of all ages.

Train for an evolving workforce

The expected influx of a large number of new and inexperienced miners could lead to a sharp increase in injuries. Since many of the new employees will be coming from a generation with different life and educational experiences than the currently predominant Baby-Boomers, effective training content and methods will have to be tailored to their specific needs. Their strengths and weaknesses should guide the development, implementation, and evaluation of the training that will prepare them for their mining careers. Training innovations will continue to be needed as the new cohort of miners moves through various positions and eventually needs to be prepared for leadership roles. Research to develop training innovations and to evaluate their efficacy will be needed in the short and longer term.

Capture the experience of the retiring workforce

Finding ways to capture and pass the knowledge and skills of the current workforce on to the new generation is a critical current need. The present generation of miners, mine managers, mine inspectors, and mining engineers has accumulated a vast reserve of knowledge, skill, and judgment. Their decades of work in the mines have given them operational wisdom that cannot be easily duplicated. They are undoubtedly responsible for preventing mine explosions, mine fires, and countless traumatic injuries with actions that are not captured in textbooks or regulations. Thus, research is needed to develop mechanisms for capturing and disseminating what they have learned.

Mining Practices

Mining economics generally dictates that the "best" deposits be mined first. However, at some point in time, the "best" are gone, and it becomes necessary to conduct mining activities in more adverse geologic conditions. Some of these conditions increase safety and health risks. Underground mining of gassier coal seams, for example, presents increased risk for explosions, while mining of deposits in weaker ground presents increased risk for fall of ground injuries. These changing conditions and associated risks must be monitored to detect consequential changes. The level of on-going ground control research appears adequate to address the emerging issue, but new ventilation and methane drainage work is envisioned.

Develop improved ventilation and methane drainage practices for gassy coal seams

Gassier deposits and expansive high-production longwalls present special challenges, and given the trend toward more gas and larger panels, we need to better understand through research the interaction of the ground and gas flows from adjacent panels or coal seams above the active panel but within its fracture zone. Research is needed to develop mine ventilation design methodologies and operational practices to prevent dangerous or unexpected accumulations of gas.

Other emerging practices

Remote control, tele-operation, automation and "intelligent" mining equipment will be effective means to prevent injuries. Improved remote sensing and "smart" data processing of roof, ventilation and equipment conditions will lead to better information for miners and mine operators and give them advanced warning of adverse or hazardous conditions. Wireless communication technologies used at the surface today will find their way into the underground mining operations and will help miners and managers improve day-to-day as well as emergency communications, promoting safer working conditions and practices. Further research is needed to fully and effectively integrate these emerging technologies into the underground environment with its requirements for permissibility and a topology that limits the spread or bandwidth of wireless signals.

Overall improvements to mining safety and health, as captured in the injury statistics, have leveled off in recent years. Many have suggested that further reductions in injuries will require "cultural" changes among management and workers and/or different approaches to workplace safety. We have identified two areas that we believe show promise and are consistent with our mission. The first is to examine the merits of a risk-based rather than regulatory-based approach to mine safety. We have funded a pilot study in this area, and found the preliminary results to be promising. As a result, we intend to initiate a program, primarily through research contracts, to conduct more complete analyses of these approaches. The second is to examine quantitatively the effectiveness of individual health and safety interventions that are part of a larger mix of activities within an organization's health and safety program. Again, pilot studies were conducted, and based on the promising findings, a full program will be initiated through research contracts.

Changing work practices, shift length, shift schedules, and "fly-in and fly-out" operations are increasing, and studies conducted by Australian researchers suggest possible adverse health and safety consequences of some practices. Moreover, an increased awareness of workplace stress and cardiovascular disease, depression, and other concerns may necessitate further study of these practices. As a first step in this area, we have begun discussions with Australian researchers aimed at building on their work through possible joint research projects.

The existing mining surveillance program includes components specifically designed to detect events that may signal future problems. For example, the chemical hazards program within mining has been investigating the potential hazards from acrylamide used in coal preparation, methacrylate used in spray-on liners, and welding fumes, among other hazards. Another example is the "CWP Hot Spots" program with NIOSH´s Division of Respirable Disease Studies, in which their surveillance of black lung disease is used to identify areas where

traditional engineering interventions are failing. These areas are then examined by mining researchers to determine the cause of the "hot spot" and to introduce appropriate interventions. The Health Hazards Evaluation program operated by NIOSH's Division of Surveillance, Hazard Evaluation, and Field Studies serves the mining sector and is an effective mechanism for identifying emerging chemical hazards. Examples of current work initiated after identification of an emerging issue are found throughout these briefing documents, as are examples of activities to learn of new issues as they emerge.